

CY2009 WV GHG Emission Inventory Instructions

January 2010

Affected Facilities

Facilities in West Virginia that emit one or more greenhouse gases (GHG) greater than the *de minimis* amounts in Table 1 and complete an emissions inventory will be required to include emissions of greenhouse gases in their regular emissions inventory for calendar year (CY) 2009, to be submitted by April 30, 2010.

Facilities will not be billed for greenhouse gases on their Certified Emissions Statement Invoice.

Reporting Requirements

Actual Point Source emission estimates will be reported in units of short tons (US) per year, unless otherwise specified. West Virginia GHG emission inventory process generally requires estimation of only larger and direct emissions (i.e., emissions originating from processes on-site, not from related vehicle fleets, electricity purchased from off-site supplier, etc.). Firms reporting GHG emissions for programs such as [The Climate Registry](#) and [EPA's Climate Leaders](#) are required to report both direct and in-direct emissions. Table 1 identifies the greenhouse gases to be reported.

Table 1. GHGs Required in WV Emission Inventory		
Pollutant Name	Chemical Name	<i>de minimis</i> amount tons/yr
Carbon Dioxide	CO ₂	10,000
Methane	CH ₄	476
Nitrous Oxide	N ₂ O	32.6
Sulfur Hexafluoride	SF ₆	0.42
Perfluorocarbons	PFCs see Table 2	1.09
Hydrofluorocarbons	HFCs see Table 2	0.855

West Virginia Title V facilities reporting GHG emissions will follow the same procedures as those used to report criteria, hazardous, and toxic air pollutants. That is, GHG emissions will be reported for all permitted sources. Only the combined facility-wide emissions of greenhouse gases emitted above the *de minimis* amounts listed in Table 2 are to be reported.

All emissions will be reported via the emissions inventory software, Satellite *i*-STEPS, Version 5.0. For more information regarding the emissions inventory submission process, please contact Dave Porter at david.j.porter@wv.gov.

This document provides information and guidance on estimating GHG emissions. These instructions were developed based on our current state of knowledge. DAQ expects to modify these instructions to build the emissions inventory into a form that is consistent as possible with developing regional, national, and international GHG emissions programs.

Some facilities will be also be affected by the [EPA Mandatory Greenhouse Gas Reporting Rule](#), published in the *Federal Register* on October 30, 2009. The rule does not require control of GHG emissions, it requires that sources above certain threshold levels monitor and report

emissions directly to EPA. In general, EPA proposes that suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons of carbon dioxide equivalent (CO₂e) or more per year of GHG emissions submit annual reports to EPA. The gases covered by the proposed rule are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur hexafluoride (SF₆), and other fluorinated gases including nitrogen trifluoride (NF₃) and hydrofluorinated ethers (HFE).

Greenhouse Gas Overview

Gases that trap heat in the atmosphere are often called greenhouse gases (GHG). For more information on the science of climate change, please visit [EPA's Climate Change science home page](#). Some GHGs, such as methane (CH₄) and carbon dioxide (CO₂), also occur naturally and are emitted to the atmosphere through natural processes as well as human activities. Other GHGs such as fluorinated gases are created and emitted solely through human activities. The principal GHGs that enter the atmosphere because of human activities are:

Carbon Dioxide (CO₂): Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Since combustion is a stoichiometric chemical reaction, the relation of CO₂ to carbon burned is well established (12 pounds of carbon burn to form 44 pounds of CO₂). CO₂ is also removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle, absorbed through the ocean-atmosphere exchange, or potentially as they may be injected into receptive geological strata.

Methane (CH₄): Methane is emitted naturally from the ground, mines, and ocean, and during the production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of livestock waste and other agricultural operations and by the anaerobic decay of organic waste in landfills, sewage treatment, and many other operations.

Nitrous Oxide (N₂O): Nitrous oxide is emitted during agricultural and industrial activities. There are also limited emissions during combustion of fuels and solid waste. However, under complete combustion situations, most oxides of nitrogen will tend to be more completely oxidized into NO₂, which is not considered a GHG.

Fluorinated Gases: Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) are synthetic compounds. They are potent greenhouse gases that are emitted from a variety of industrial processes and leaks. Fluorinated gases are sometimes used as substitutes for [ozone-depleting substances](#) (i.e. CFCs, HCFCs, and halons). These gases are typically emitted in smaller quantities, but because of their potency, they are sometimes referred to as High Global Warming Potential gases (“High GWP gases”). A detailed list of gases identified by the [Intergovernmental Panel on Climate Change](#) as GHGs is listed below. The *de minimis* values are facility-wide values below which it is currently not necessary to report. Though we would like to know your speciated emissions of HFCs and PFCs, the current version of *i*-STEPS does not contain pollutant codes for each species. Report your total emissions of hydrofluorocarbons as “HFC” and your total emissions of perfluorocarbons as “PFC”.

Table 2. GHG <i>de minimis</i> and Global Warming Potentials					
CAS or Pollutant Code	Chemical Formula	Chemical Name	<i>de minimis</i> (ton/year)	IPCC 1995 ^a (100-Year GWP)	IPCC 2001 ^b (100-Year GWP)
124389	CO ₂	Carbon Dioxide	10,000	1	1
74828	CH ₄	Methane	476	21	23
10024972	N ₂ O	Nitrous Oxide	32.6	310	296
2551624	SF ₆	Sulfur Hexafluoride	0.42	23,900	22,200
Perfluorocarbons (PFC)					
	PCF	Perfluorocarbons	1.09		
115253	C ₄ F ₈	Perfluorocyclobutane (octafluorocyclobutane)	Collective	8,700	10,000
355259	C ₄ F ₁₀	Perfluorobutane (decafluorobutane)	Collective	7,000	8,600
76164	C ₂ F ₆	Perfluoroethane (hexafluoroethane)	Collective	9,200	11,900
355420	C ₆ F ₁₄	Perfluorohexane (tetradecafluorohexane)	Collective	7,400	9,000
75730	CF ₄	Perfluoromethane (tetrafluoromethane)	Collective	6,500	5,700
678262	C ₅ F ₁₂	Perfluoropentane (dodecafluoropentane)	Collective	7,500	8,900
76197	C ₃ F ₈	Perfluoropropane (octafluoropropane)	Collective	7,000	8,600
Hydrofluorocarbons (HFC)					
	HFC	Hydrofluorocarbons	0.855		
75467	CHF ₃	HFC-23 (trifluoromethane)	Collective	11,700	12,000
75105	CH ₂ F ₂	HFC-32 (difluoromethane)	Collective	650	550
593533	CH ₃ F	HFC-41 (fluoromethane)	Collective	150	97
138495428	CF ₃ CHFCHFCF ₂ CF ₃	HFC-43 (10mee (1,1,1,2,3,4,4,5,5,5-decafluoropentane)	Collective	1,300	1,500
354336	CHF ₂ CF ₃	HFC-125 (pentafluoroethane)	Collective	2,800	3,400
359353	CHF ₂ CHF ₂	HFC-134 (1,1,2,2-tetrafluoroethane)	Collective	1,000	1,100
811972	CH ₂ FCF ₃	HFC-134a (1,1,1,2-tetrafluoroethane)	Collective	1,300	1,300
430660	CHF ₂ CH ₂ F	HFC-143 (1,1,2-trifluoroethane)	Collective	300	330
420462	CF ₃ CH ₃	HFC-143a (1,1,1-trifluoroethane)	Collective	3,800	4,300
624726	CH ₂ FCH ₂ F	HFC-152 (1,2-	Collective	43*	43

		difluoroethane)			
75376	CH ₃ CHF ₂	HFC-152a (1,1-difluoroethane)	Collective	140	120
353366	CH ₃ CH ₂ F	HFC-161 (fluoroethane)	Collective	12*	12
431890	CF ₃ CHFCF ₃	HFC-227ea (1,1,1,2,3,3,3-heptafluoropropane)	Collective	2,900	3,500
60598110	CH ₂ FCF ₂ CF ₃	HFC-236cb (1,1,1,2,3,3-hexafluoropropane)	Collective	1,300*	1,300
431630	CHF ₂ CHFCF ₃	HFC-236ea (1,1,1,2,3,3-hexafluoropropane)	Collective	1,200*	1,200
690391	CF ₃ CH ₂ CF ₃	HFC-236fa (1,1,1,3,3,3-hexafluoropropane)	Collective	6,300	9,400
679867	CH ₂ FCF ₂ CHF ₂	HFC-245ca(1,1,2,2,3-pentafluoropropane)	Collective	560	640
460731	CHF ₂ CH ₂ CF ₃	HFC-245fa (1,1,3,3-pentafluoropropane)	Collective	950*	950
431630	CF ₃ CH ₂ CF ₂ CH ₃	HFC-365mfc (1,1,1,3,3-pentafluorobutane)	Collective	890*	890

^a Source: Intergovernmental Panel on Climate Change, Second Assessment Report, 1995

^b Source: Intergovernmental Panel on Climate Change, Third Assessment Report, 2001 : [Climate Change 2001: The Scientific Basis](#)

Note: The standard practice used by EPA, TCT, and other organizations is to use IPCC 2nd Assessment Reported GWPs. Conversion to more updated GWPs may occur in the coming years. To maintain consistency, the WV DAQ will convert mass emission rates of GHGs to CO₂ equivalent basis using the GWPs used by EPA, currently IPCC 1995.

*Assigned based on IPCC 2001 GWPs

Global Warming Potential

Due to their infrared radiation absorption characteristics, each GHG generally has a different *global warming potential*. Studies have provided a “potency” factor for many individual substances. This factor defines the infrared radiation trapping potential of these substances relative to that of CO₂ and establishes these ratios as a number (absolute or unit-less) to estimate the Global Warming Potential (GWP) of that substance. This ratio times the quantity emitted results in the CO₂ equivalent (CO_{2e}) of those emissions. For example, a ton of methane is approximately equivalent (regarding the light/energy retention of the atmosphere) to 21 tons of CO₂.

When reporting GHG emissions to WV DAQ, facilities must report actual emissions (i.e., do not report equivalencies). Table 2 contains the GWP factors for information purposes only. However, separate reporting to groups such as [The Climate Registry](#) (TCR) may require reporting in GHG equivalents, in accordance with their respective protocols.

Emission Factors and Emission Estimation Methods

The WV emission inventory process generally requires the estimation of only larger and direct emissions. Emissions to be reported will be on a scale of short tons (US) per year. Major categories to include in your GHG emission inventory are:

Stationary Combustion
Process Emissions
Fugitive Emissions

Emission factors for common GHG sources (e.g., combustion of various carbon-based fuels) have been developed and tabulated in many places. Usually, these factors are in good agreement, but may be in units that are not familiar to some users. The [IPCC](#) has developed internationally accepted methods and factors for preparing GHG inventories and other groups such as [TCR](#), [The California Climate Action Registry](#), [EPA](#) and [The Greenhouse Gas Protocol Initiative](#) are constantly improving on the volume, variety, and detail of such emission factors.

The [Revised 1996 IPCC Guideline](#), along with [IPCC Good Practice](#), form the basis of existing U.S. (national) and many individual state inventories. The [2006 IPCC Guidelines](#) contain updated and expanded information that may prove useful to some facilities in these efforts. The IPCC Guidelines provide flexibility to use a range of methods and data, reflecting the diversity of national circumstances around the world. West Virginia's instructions and procedures are intended to take full advantage of the existence of these guidelines and their flexibility so that they apply specifically to situations that exist in West Virginia.

DAQ has listed the recommended guidance documents for several GHG emission sources. Emission sources for which DAQ guidance has not yet been identified, facilities are encouraged to use the methods developed by many respectable organizations (see links at the end of these instructions) or call the agency for help.

Table 3. GHG Emission Estimation Guidance Documents

Emission Sources	Primary GHGs Emitted	Guidance Documents
Stationary Combustion	CO ₂ , CH ₄ , N ₂ O	EPA –Mandatory Reporting Rule, Subpart C – General Stationary Fuel Combustion Sources The Climate Registry (TCR) General Reporting Protocol, Version 1.0, March 2008, Chapter 12 World Resources Institute (WRI) GHG Protocol – Stationary Combustion Guidance, Version 3.0, July 2005 EPA Climate Leaders GHG Inventory Protocol – Direct Emissions from Stationary Combustion Sources, May 2008
Refrigeration and Air Conditioning	HFC, PFC	TCR General Reporting Protocol, Chapter 16 EPA – Climate Leaders GHG Inventory Guidance, Direct HFC and PFC Emissions from Refrigeration and AC Equipment The GHG Protocol Initiative – HFC and PFC emissions from Refrigeration and AC Equipment
Adipic Acid Production	N ₂ O	EPA – Mandatory Reporting Rule, Subpart E – Adipic Acid Production TCR General Reporting Protocol, Appendix E.1 The GHG Protocol Initiative – N2O Emissions From Production of Adipic Acid
Aluminum Production	CO ₂ , PFC	EPA – Mandatory Reporting Rule, Subpart F – Aluminum Production TCR General Reporting Protocol, Appendix E.2 The GHG Protocol Initiative – CO2 Emissions From Production of Aluminum
Ammonia Production	CO ₂	EPA – Mandatory Reporting Rule, Subpart G – Ammonia Manufacturing TCR General Reporting Protocol, Appendix E.3 The GHG Protocol Initiative – CO2 Emissions From Production of Ammonia
Cement Production	CO ₂	EPA – Mandatory Reporting Rule, Subpart H – Cement Production TCR General Reporting Protocol, Appendix E.4 The GHG Protocol Initiative – CO2 Emissions From Production of Cement
Electricity Transmission and Distribution	SF ₆	EPA – Mandatory Reporting Rule, Subpart D – Electricity Generation EPA – Proposed Mandatory Reporting Rule, Subpart DD – Sulfur Hexafluoride (SF6) From Electrical Equipment TCR General Reporting Protocol, Appendix E.5
HCFC-22 Production	HFC	EPA – Mandatory Reporting Rule, Subpart O—HCFC–22 Production and HFC–23 Destruction TCR General Reporting Protocol, Appendix E.6

		The GHG Protocol Initiative – HCFC-23 Emissions From Production of HCFC-22
Iron and Steel Production	CO ₂	EPA – Mandatory Reporting Rule, Subpart Q – Iron and Steel Production TCR General Reporting Protocol, Appendix E.7 The GHG Protocol Initiative – CO2 Emissions From Production of Iron and Steel EPA – Climate Leaders GHG Inventory Guidance, Direct Emissions from Iron and Steel Production
Lime Production	CO ₂	EPA – Mandatory Reporting Rule, Subpart S—Lime Manufacturing TCR General Reporting Protocol, Appendix E.8 The GHG Protocol Initiative – CO2 Emissions From Production of Lime
Municipal Solid Waste Disposal (landfilling)	CH ₄	EPA – Mandatory Reporting Rule, Subpart HH - Landfills EPA – Climate Leaders GHG Inventory Guidance, Direct Emissions From MSW Landfilling
Pulp and Paper Production	CO ₂ , CH ₄	EPA – Mandatory Reporting Rule, Subpart AA – Pulp and Paper Manufacturing TCR General Reporting Protocol, Appendix E.10 The GHG Protocol Initiative – GHG Emissions From Pulp and Paper Mills
Refrigeration and AC Equipment Manufacturing	HFC, PFC	TCR General Reporting Protocol, Appendix E.11
Semiconductor Manufacturing	PFC, SF ₆	EPA – Proposed Mandatory Reporting Rule, Subpart I – Electronics Manufacturing TCR General Reporting Protocol, Appendix E.12
Oil and Natural Gas	CO ₂	EPA – Proposed Mandatory Reporting Rule, Subpart W – Oil and Natural Gas Systems World Resources Institute Discussion Paper for a Natural Gas Transmission and Distribution Greenhouse Gas Reporting Protocol Final Draft Report (see Chapters VI.6.1, VI.6.2, and VII)
Municipal Solid Waste Combustion, Limestone and Dolomite Use, Soda ash Consumption	CH ₄ , CO ₂	EIIP Volume 8 p. 13.4-14 EPA – Mandatory Reporting Rule, Subpart U – Miscellaneous Uses of Carbonate

Links to guidance documents:

<http://www.epa.gov/climatechange/emissions/ghgrulemaking.html>

EPA – Proposed Mandatory GHG Reporting Rule, April, 2009

<http://www.theclimateregistry.org/downloads/GRP.pdf>

TCR – General Reporting Protocol Version 1.1, May 2008

<http://www.ipcc.ch/index.htm>

Intergovernmental Panel on Climate Change, April, 2009

Links to other resources:

<http://www.epa.gov/climatechange/>

EPA – Climate Change Web-page, March 2009

<http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

EPA – GHG Equivalencies Calculator, February 2009

http://www.epa.gov/climatechange/emissions/ghg_infosheets.html

EPA - Information Sheets for Each of the Source Categories Covered in the Proposed Rule, April 2009

For Additional Questions or Comments Contact:

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